

Customer No. 24498
Ser. No. 10/581,873
Internal Docket No. PD030127

Remarks/Arguments

In the non-final Office Action dated December 12, 2007, it is noted that claims 1-14 are pending; that the drawings are objected to; that claims 1-14 are rejected; and that claim 3 is objected to.

In the present amendment, Claim 1 has been amended by clarifying that the transmission of memory bank commands “**of multiple channels**” is prioritized on the basis of a static priority allocation for commands and a dynamic priority allocation for the channels. This is originally disclosed on page 8, line 26-33 of applicants’ specification. Independent claim 13 is likewise changed accordingly.

Claim 3 has been amended with respect to clarifying the grammar. Claim 5 has been amended for clarity as suggested by the examiner. Claim 14 has been amended to clarify the inventive features. No new matter has been added.

Objection to the drawings

In the Office Action it is noted that Transmit NOP 19 of the drawings is not mentioned in the specification. Applicants have amended the specification herein beginning at page 11, line 34 to include the reference designator 19 to the command NOP transmission description.

Figures 2 and 3 are objected to as requiring additional labels. Applicants have included replacement sheets which include amendments to Figures 2 and 3. The amendments include additional labels based on the description in the specification. No new matter is entered.

In view of the above mentioned amendments, it is respectfully requested the objections to the drawings be withdrawn.

Informality objection to claim 3

Applicants submit that the objection to claim 3 is obviated by the clarifying amendment herein.

Rejection of claim 5 under 35 USC §112

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Claim 5 has been amended herein substantially as suggested by the Examiner.
In view of this clarification it is respectfully requested this rejection be withdrawn.

Rejection of claims 1, 5, 10, 13 and 14 under 35 USC §102(b) as being anticipated by Chauvel et al. (US Pat No 6,412,048) (hereinafter “Chauvel”)

Chauvel appears to teach a method for controlling memory access where there are a plurality of requests. Chauvel teaches in Fig. 4 a certain order of commands (deactivate, activate, read/write; 54, 56, 59; 68, 70, 64). This order of commands has to be followed in every DRAM access routine. The access routine presented by Chauvel in Fig. 4 shows a flow chart to be followed if one channel accesses a specific memory part in the DRAM.

Channels are prioritized by Chauvel according to Table 2 shown in col. 15. Prioritization of channels can be changed, for example, see column 15, lines 20-24.

Thus, it appears that Chauvel teaches the prioritization of channels; however, once a channel is selected, then the all commands as described in Fig. 4 are transmitted in a predefined order.

In other words, according to the teaching of Chauvel, a priority would be defined for a channel, for example for the Input channel. Then all commands necessary for this operation according to Fig. 4-Chauvel would be transmitted (activate (56, 70), read/write (49, 64), precharge (not shown in Fig. 4-Chauvel)). Then the next channel would be selected according to its priority and the necessary commands would be transmitted. In Chauvel the priority of commands is not considered across multiple channels, only the channel priority is considered, then the commands transmitted in order.

In contrast, applicants' claim 1 recites a method for communication between an IC and an external DRAM, where the external DRAM has at least one memory bank and communicates with the IC via two or more channels. The transmission of memory bank commands of multiple channels is prioritized on the basis of a static priority allocation for commands and a dynamic priority allocation for channels.

Thus, in Chauvel a channel would be selected according to the priority and then all the commands transmitted in order. Chauvel does not prioritize the commands of

multiple channels. For example, in Chauvel if the Read or Write command takes precedence, the command would only take precedence in the selected channel. The command would not take precedence over a lower priority command on another channel. In Chauvel the priority of commands is not considered across multiple channels, only the channel priority is considered, then the commands transmitted in order.

In contrast, according to applicants' claim 1 transmit commands of multiple channels are prioritized according to a static priority for commands and a dynamic priority for channels.

For example, according to an embodiment, if multiple channels request to access the DRAM at the same time, the requests are not handled one after another according to channel priority as in Chauvel. According to an embodiment of applicants, commands of multiple channels are analyzed according to their static priority for commands (see Table on page 5). For this analysis it is not relevant which channel requests to transmit the command. If there are multiple commands with the same priority, they are transmitted according to the dynamic prioritization of channels according to Fig. 4 of the present application. This is disclosed on page 9, lines 8-17 of the specification.

The following example and table may be useful in explaining applicants' claimed invention and shows which commands are executed according to the inventive method, if first the Input channel requests a Write operation, afterwards the Output channel request a Read operation and further, the AMBA channel requests a Write operation. The execution times of the operations overlap. It is assumed that an Activation command requires three timeslots according to Fig. 1 of the present application. A Write or Read command requires a single time slot, a Precharge command requires three time slots. Multiple Read and Write commands can be requested after one Activation command. It is assumed that the channels access memory areas (for example different memory banks) from which no access conflicts will occur. From time slot 1 to 4 only one command is pending in the command scheduler, which is therefore directly transmitted. In time slot 5 a Write command of the Input channel Write(I) is pending at the same time as a Read command of the Output channel Read(O). Write and Read commands have the same static priority. Therefore, the commands are

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transmitted according to the dynamic priority allocation for channels. Assuming that in time slot 5 the state machine according to Fig. 4 is in the upper right state, the Output channel has the higher priority than the Input channel. Therefore, the Read command of the Output channel Read(O) will be transmitted. The state machine according to Fig. 4 will then change to the lower left state, because a command of the Output channel was executed. The AMBA channel now has the highest dynamic priority and therefore, the Write command of the AMBA channel Write(A) is transmitted in time slot 6. After all commands with a high priority (Read and Write) are transmitted (time slot 10), the commands with the next static priority (Precharge) are transmitted in timeslots 10-12 according to they dynamic priority given by the state machine according to Fig. 4.

Time Slot	Input	AMBA	Output	Commands in scheduler	Command Executed
1	Act(I)			Act(I)	Act(I)
2	--		Act(O)	Act(O)	Act(O)
3	--	Act(A)		Act(A)	Act(A)
4	Write(I)			Write(I)	Write(I)
5	Write(I)		Read(O)	Write(I) + Read(O)	Read(O)
6	Prech(I)	Write(A)	Read(O)	Write(I) + Prech(I) + Write(A) + Read(O)	Write(A)
7	--	Write(A)	Prech(O)	Write(I) + Prech(I) + Read(O) + Write(A) + Prech(O)	Write(I)
8	--	Prech(A)	--	Prech(I) + Read(O) + Write(A) + Prech(O) + Prech(A)	Write(A)
9	(Next request)	--	--	Prech(I) + Read(O) + Prech(O) + Prech(A)	Read(O)
10		--	(Next request)	Prech(I) + Prech(O) + Prech(A)	Prech(A)
11		(Next Request)		Prech(I) + Prech(O)	Prech(I)
12				Prech(O)	Prech(O)

In contrast, according to the teaching of Chauvel, a priority would be defined for a channel, for example for the Input channel. Then all commands necessary for this operation according to Fig. 4-Chauvel would be transmitted (activate (56, 70), read/write (49, 64), precharge (not shown in Fig. 4-Chauvel)). Then the next channel would be selected according to its priority and the necessary commands would be transmitted. A completely different order of transmitted commands would arise using the teaching of Chauvel.

Therefore, Applicants submit that for at least the reasons recited above independent claim 1 is not anticipated by the teachings of Chauvel, as such, fully satisfies the requirements of 35 U.S.C. § 102 and is patentable there under.

Furthermore, defendant claims 5, 10 and 14 depend directly or indirectly from independent claim 1 and recite additional features therein. As such and for at least the reasons set forth herein, Applicants submit that defendant claims 5, 10 and 14 are also not anticipated by the teachings of Chauvel and fully satisfy the requirements of 35 U.S.C. § 102 and are patentable thereunder.

Since claim 13 includes apparatus features substantially similar to those found in claim 1, it is also submitted that Chauvel does not teach, show, or suggest all the elements of Applicants' claim 13, as such, claim 13 fully satisfies the requirements of 35 U.S.C. § 102 and is patentable there under.

Rejection of claim 2 under 35 USC 103(a) as unpatentable over Chauvel in view of Kirsch (US 2004/0054844).

With regard to claim 2 it is argued that Chauvel teaches certain commands have precedence over other commands. For example, Read or Write commands having the highest priority.

However, Chauvel only teaches that the order is provided or followed after the channel is selected. Chauvel does not teach the features of claim 1 as discussed above. The further reference Kirsch likewise fails to teach the claimed features.

Therefore, it is respectfully submitted that the combination of references fails to render the claim obvious since the combination lacks elements of the claimed invention. Therefore, it is respectfully submitted that claim 1 is not anticipated by Chauvel.

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Rejection of claim 3, 4, 6, 7-9, 11, and 12 under 35 USC 103(a) as unpatentable over Chauvel in view of further references.

It is respectfully submitted that none of the further references show or give a hint to transmit commands of multiple channels according to a static priority for commands and a dynamic priority for channels. Each claim includes further distinguishing features not found in each cited combination of references. The claimed invention provides advantages over the references by, for example, providing a higher data throughput with reduced waiting times can be realized. Thus, applicants essentially repeat the above arguments for each dependent claim and respectfully request each rejection be withdrawn.

Conclusion

Having fully addressed the Examiner's rejections it is believed that, in view of the preceding amendments and remarks, this application stands in condition for allowance. Accordingly then, reconsideration and allowance are respectfully solicited. If, however, the Examiner is of the opinion that such action cannot be taken, the Examiner is invited to contact the applicant's attorney at (609) 734-6813, so that a mutually convenient date and time for a telephonic interview may be scheduled.

No fee is believed to have been incurred by virtue of this amendment. However if a fee is incurred on the basis of this amendment, please charge such fee against deposit account 07-0832.

Respectfully submitted,
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//Reitseng Lin//

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